

### Remarks

Claims 1-5, 7-23, 25-31, 36-64, 66, 67, and 69-71 are pending in the present application, of which claim 1-5, 7-22, 43-46, 50-64, 66, and 67 were withdrawn from consideration. This response addresses the rejection of claims 23, 25-31, 36-42, 47-49, and 69-71 in the Final Office Action dated Sept. 21, 2007.

As indicated above, claim 36 is amended, no claims are cancelled, and no claims are added.

#### The 35 U.S.C. §112, Second Paragraph, Rejection

Claim 36 was rejected under 35 U.S.C. § 112, second paragraph, for allegedly failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Applicants respectfully traverse the rejection and request reconsideration and withdrawal of the rejection.

The Examiner asserts that claim 36, dependent upon claim 25, is confusing because it is allegedly unclear as to what the term "sol-gel material" is referring to. Claim 25 recites "a cross-linked metal oxide or silicon oxide based sol-gel material" which is formed by crosslinking, with an organic compound, the surfaces of the "preformed metal oxide or silicon oxide based sol-gel material" to form the "cross-linked ... sol-gel material."

The recitation of the "sol-gel material" being silica based clearly applies only to composition the inorganic component, i.e., the "metal-oxide or silicon oxide based sol-gel material," which may or may not be cross-linked with an organic compound. The "silica" limitation applies only to the inorganic component of either sol-gel material, and no confusion can arise, as both the preformed sol-gel material and the cross-linked sol-gel material are silica based in claim 36, because a "preformed silica based sol-gel material" prior to crosslinking is necessarily also a "silica based cross-linked sol-gel material" after crosslinking. The organic compound cannot be silica based, because silica is not organic.

However, to advance the prosecution of the application, claim 36 is amended to recite the "sol-gel material of claim 25, wherein the preformed metal oxide or silicon oxide based sol-gel material is silica based." Support for this amendment is found in the language of claim 25, *inter alia*.

Therefore, this rejection is deemed to be overcome. Applicants request withdrawal of the rejection with respect to claim 36 as amended herein.

#### The 35 U.S.C. §102 Rejections

Claims 23, 25-31, 36-42, 47-49, and 69-71 were rejected under 35 U.S.C. §102(a) as being anticipated by Leventis, et al. (Nano Letters document). Applicants respectfully traverse the rejection and request reconsideration and withdrawal of the rejection.

A declaration under 37 C.F.R. §1.132 is attached hereto, in which the applicants herein, Nicolas Leventis and Chariklia Leventis, declare that they are the sole inventors of the subject matter of the claimed invention, and that the coauthors of the Nano Letters document, Guohui Zhang and Abdel-Monem M. Rawashdeh, were merely students working under the direction and supervision of the Professors Leventis, and did not and do not meet the standard of inventorship applicable to a U.S. Patent Application. The declaration submitted herewith explicitly states that applicants are the sole inventors of the subject matter and that the others were merely working under their direction. Therefore, this rejection is deemed to be overcome. Applicants request withdrawal of the rejection with respect to the claims as amended herein.

Claims 23, 25-31, 36-42, 47-49, and 69-71 were rejected under 35 U.S.C. §102(b) as being anticipated by Novak et al. (Chem. Mater. document). Applicants respectfully traverse the rejection and, to the extent maintained with respect to the claims as amended herein, request reconsideration and withdrawal of the rejection.

For anticipation to be found, each and every element of the claimed invention must be found within the cited reference. Novak fails to disclose a number of elements of the presently claimed invention (e.g., as recited in independent claims 23 and 25), upon which all other claims

under consideration depend. Therefore, a rejection under §102(b) based on Novak is not appropriate.

Novak discusses two situations: first (page 283, first full paragraph) describes an organic-inorganic composite material wherein "the organic polymer, TMOS [tetramethylorthosilicate] and water are mixed with the appropriate amount of cosolvent ... and the pH is adjusted to approximately 5. After gelation ... and aging ... the gels are soaked ..." (page 283, first column, 2<sup>nd</sup> para, lines 12-16). In other words, the organic polymer is present first, the silica gel precursor TMOS is introduced, and silica gel formation takes place in a solution containing the organic polymer already in intact form. This is completely different from what is recited in claims 23 and 25, wherein it is made clear that a "silicon oxide based sol-gel material" is formed first, to provide a "preformed ... silicon oxide based sol-gel material," and then and only then is a "cross-linking agent, . . . comprising an organic compound" introduced to contact the preformed sol-gel material (claim 23), or deposited on surfaces of the preformed silicon oxide based sol-gel material (claim 25) to provide the "cross-linked . . . silicon oxide based sol-gel material," i.e., by reacting with functional groups on the silica gel surface in more than a single location per cross-linking molecule (e.g., in two or three places on the silica surface, to form the "cross-link"). The temporal sequence of these steps is explicitly recited in claims 23 and 25. Therefore, the inventive cross-linked sol-gel material cannot be anticipated by this first form of Novak's disclosure, because in the present invention the silica, instead of the organic polymer, is formed first, and cross-linking of the silica as opposed to mere organic polymerization, takes place.

Novak's second form described in the Chem. Mater. document involves "simultaneously carrying out the sol-gel condensation reaction and an independent free-radical polymerization of the appropriate vinyl monomer" (page 283, second column, paragraph 3, lines 1-4). Novak describes the product of this reaction as "interpenetrating networks." Again, this cannot anticipate the instant invention of claims 23 and 25 and all remaining claims dependent thereon, as the present invention explicitly recites a temporal sequence of first forming the silica (or metal oxide) sol-gel material, and after that is formed, then cross-linking that preformed structure with the organic cross-linking agent. In contrast, Novak merely forms two "interpenetrating

networks" "simultaneously." Furthermore, the distinction between a cross-linking agent (the present application) and a monomer for polymerization (Novak) should be noted. Cross-linking agents are difunctional or polyfunctional reagents that react at least twice with different domains of a substrate (e.g., silica gel network) and not necessarily with other molecules of the same reagent, whereas monomers are reagents that react with other molecules of the same reagent to form a macromolecule. Thus, this form of Novak's composite likewise cannot anticipate the present invention.

Therefore, withdrawal of the rejections made on the basis of the Novak document is appropriate, and is respectfully requested by Applicants herein.

Claims 23, 25-31, 36-42, 47-49, and 69-71 were rejected under 35 U.S.C. § 102(e) as being anticipated by Yim et al. (Korean J. Chem. Eng. document). Applicants respectfully traverse the rejection and, to the extent maintained with respect to the claims as amended herein, request reconsideration and withdrawal of the rejection.

For anticipation to be found, each and every element of the claimed invention must be found within the cited reference. Yim fails to disclose a number of elements of the present invention as recited in the instant independent claims 23 and 25, upon which all other claims under consideration depend. Therefore, a rejection under § 102(e) based on Yim is not appropriate.

Yim states that "in the present work, a chemical reaction route of obtaining a hybrid wet gel was devised by bonding the organic functional groups in polymeric MDI with tetramethyl orthosilicate (TMOS) that is the feed material to get silica aerogel" (page 160, paragraph 1, lines 1-4). MDI is a diisocyanate, namely diphenylmethane-4,4'-diisocyanate. In other words, according to Yim, the MDI diisocyanate is polymerized, and then is bonded with TMOS, the monomer used for the subsequent polymerization to yield the silica gel. Any cross-linking by the isocyanate reagent takes place before, or concurrently with, the formation of the silica gel, not subsequent as in the present invention. In section 1 (page 160), it is stated that "the hybrid wet gel for further aging was obtained by adding polymeric MDI and catalyst to the partially condensed silica solution" (emphasis added). Thus, even if some TMOS reaction may have

occurred, the material is in a solution, not in a gelled state, when the isocyanate reagent is added. This is in contrast to the present claims 23 and 25 and claims dependent thereon, wherein it is clearly recited that the silicon oxide based sol-gel material is preformed before reaction with a non-polymeric diisocyanate or polyisocyanate; and, in claim 25 (and claims dependent thereon), is it explicitly recited that the cross-linking agent is "deposited on surfaces of the preformed metal oxide or silicon oxide based sol-gel material." For there to be surfaces to deposit the cross-linking agent upon, there must be solid material present.

Yim describes a situation where a preformed organic polymer ("polymeric MDI") reacts with a silicon monomer (TMOS), which eventually co-condense to provide Yim's hybrid aerogel. In contrast, the present invention claims a cross-linked sol-gel material wherein a silicon oxide (silica) gel is preformed, and monomeric di- and polyisocyanates react with groups on that surface, cross-linking and strengthening the inventive material. Thus, Yim cannot anticipate the instant invention.

Accordingly, withdrawal of the rejections under §102(e) is respectfully requested by the Applicants herein.

Conclusion

Applicant respectfully submits that the claims are in condition for allowance, and notification to that effect is earnestly requested. The Examiner is invited to telephone Applicant's attorney at (612) 373-6905 to facilitate prosecution of this application.

If necessary, please charge any additional fees or credit overpayment to Deposit Account No. 19-0743.

Respectfully submitted,

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CERTIFICATE UNDER 37 CFR 1.8: The undersigned hereby certifies that this correspondence is being filed using the USPTO's electronic filing system EFS-Web, and is addressed to: Mail Stop RCE, Commissioner of Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on this

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